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COAL-TAR AND AMMONIA.

Coal-Tar and Ammonia. By Prof. G. Lunge. Fifth and enlarged edition. Part i. *Coal-Tar.* Pp. xxix + 527. Part ii. *Coal-Tar.* Pp. xi+531 to 1037. Part iii. *Ammonia.* Pp. xvi+1041 to 1658. (London: Gurney and Jackson, 1916.) Price, three parts, 3*l.* 3*s.* net.

THIS well-known book is one of the acknowledged classics of chemical technology. Originally published in 1882, it has now reached its fifth edition. Perhaps nothing could possibly serve to illustrate more strikingly the extraordinary development of chemical industry during the past third of a century than a comparison of the contents and size of the volumes of the successive editions. The 1882 edition, which all authorities agreed was a faithful reflection of the then condition of this particular industry, consisted of a modest volume of some 370 pages, of which about 300 treated of coal-tar, its origin, properties, distillation, fractionation, etc., while fewer than sixty pages were devoted to the subject of ammoniacal liquor, its treatment, and the manufacture of the more industrially important ammoniacal salts, the remainder of the book comprising tabular matter, conversion tables, appendix, and index.

The present (1916) edition extends to three volumes, each of which is nearly double the size of the single volume of which the first edition consisted. Two of these volumes are taken up with coal-tar and its products, while the third treats exclusively of ammonia and its commercial compounds. It may serve to indicate the importance which this subject has assumed to state that the space which has now to be given to it is nine times greater than was needed some thirty-four years ago.

In the first edition no attempt was made to estimate the amount of the by-products obtained in the destructive distillation of coal. In the early 'eighties the industry, although no longer in its infancy, was still comparatively undeveloped, and statistics were not readily available, nor when obtained were they very consistent. Wurtz, in 1876, in connection with the early history of the coal-tar colouring matters, had estimated the total production of coal-tar in Europe at about 175,000 tons, of which Great Britain produced about 130,000 tons. Weyl, of Mannheim, some years later, put the amount for all Europe at 350,000 tons, of which England produced more than half, exclusively, of course, from gas-works. In 1880 Germany worked up only 37,500 tons. In 1883 the total production of the principal European countries was stated by Gallois to be 675,000 tons, of which Great Britain produced 450,000 tons and Germany 85,000 tons. At about that time (1884), according to a report of the directors of the South Metropolitan Gas Company, the sale of tar and sulphate of ammonia realised 82 per cent. of the initial cost of the coal incidentally employed. "Residuals," however, do not always command such prices. Tar, for example, has fluctuated in value in recent years from 26*s.* a ton in 1903 to as low as 11*s.* in 1909. Owing to the special circumstances of the times it has doubtless greatly increased in price.

The production of tar and the working up and treatment of tar-products and "residuals" generally have made enormous strides in Germany during recent years, and she is now, in all probability, no longer dependent upon outside sources as she formerly was. Very recent statistics are, of course, not to be looked for. The latest which are available for a comparison between our position and that of Germany in this respect refer to 1909, and no doubt are not strictly applicable to the present abnormal conditions. But even as they stand they are very significant, and leave no room for doubt as to their meaning.

According to the figures furnished by the author the amount of tar produced in the United Kingdom in 1909 was 1,100,000 tons, made up as follows:—

	Tons
Gas-tar	750,000
Coke-oven tar	150,000
Blast-furnace tar	200,000
	1,100,000

In the same year the aggregate production of tar from all sources in Germany was 1,012,000 tons. In other words, whilst the United Kingdom had rather more than doubled her production in about twenty-five years, Germany, during the same interval of time, had increased her supply by about twelve times the amount. There can be little doubt that her production at the present time exceeds that of the United Kingdom and that we have now definitely lost our pre-eminence in this particular industry. The greatly increased production in Germany would appear to be due to the extraordinary development of the coke-oven industry which has taken place within recent years in that country. There is at the present time about three times as much coke-oven tar produced in Germany as of gas-tar, whereas with us the amount of coke-oven tar until quite recently was barely half that of the gas-tar. This great disparity in the rate of development of this particular phase of the industry is, no doubt, due to several causes, some of them, possibly, purely economic. On the other hand, something must be set down to the conservatism and apathy of coalowners and to the prejudice of ironmasters. It is lamentable to think how one of the greatest assets this country possesses continues to be wasted through ignorance and neglect. Some day we shall wake up to the fact that we have heedlessly squandered the potential riches with which we have been endowed.

Considering the part played by coal-tar

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products in furnishing certain of the raw materials needed in the manufacture of high explosives, the astonishing development of the coal-tar industry in Germany affords one more illustration of the means by which that country has so sedulously prepared herself for the titanic struggle upon which she has embarked.

It remains to be seen what the influence of the war will be on the future of tar production and distilling in this country. It is practically certain that Germany will no longer be the market for our intermediate tar-products that she has hitherto been. Dr. Lunge tells us, what we begin to realise, that Germany "is now in a position to furnish almost the whole of the requirements of coal-tar products for its colour industry, the largest in the world." What is in store for the colour industry with us is very difficult to forecast. Time and a more intelligent fiscal policy may tell. As we all know, attempts are being made to recover the great leeway we have lost by our lack of foresight and our want of an intelligent appreciation of the relation of science and research to industry. It is to be hoped, in the interest of our textile manufactures, that at least a certain measure of success may be reached. But it is questionable whether, on the lines of the present effort, the success will be very far-reaching. It is certain that the methods which are being employed are very different in character from those which have placed the industry in its present high position in Germany. It is no less certain that no other mode of direction than this last will be successful in the long run.

As compared with the preceding edition, which appeared in 1909, the most important factor of increase in the present work is in the section relating to ammonia, concerning which there has been a great development within recent years. Ammonia and ammoniacal compounds are, of course, used to a large and increasing extent in a great variety of industries, *e.g.* manufacture of alkali; coal-tar colours; in bleaching, dyeing, and calico-printing; in zinc-coating; explosives; artificial silk; medicine, pharmacy, and photography; and in the production of cold. But by far the largest amount of combined ammonia is used in agriculture. During the first decade of this century the consumption of ammonium sulphate rose from 125,000 to 322,000 tons, whereas during the same period the consumption of sodium nitrate rose from 470,000 to 637,000 tons—a far less rapid rate of increase than in the case of the ammoniacal salts, which is bound to get still less as the Chile beds approach exhaustion. Although synthetic methods of production of ammonia will play an increasingly important part, it is practically certain that the principal source of ammonia and its compounds will continue to be the nitrogen of coal, and it is on the development of the coking industry and on the recovery of the by-products formerly lost that the future of the ammonia industry will depend.

We heartily congratulate the veteran Professor Emeritus of the Zurich Federal Technical University on the appearance of this admirable work. Dr. Lunge deserves well of the industry which he has laboured so faithfully to serve. Every page of his treatise bears witness to the zeal and painstaking care with which it has been compiled and revised. The book, as hitherto, is admirably printed and excellently illustrated. Indeed, no efforts have been spared by all concerned to make it, what it unquestionably is, by far the most complete and authoritative work we have upon the important subjects of which it treats.

T. E. THORPE.

MATERIALS OF CONSTRUCTION.

The Structure and Properties of the More Common Materials of Construction. By G. B. Upton. Pp. v+327. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1916.) Price 10*s.* 6*d.* net.

THIS volume had its origin in a course of theoretical instruction preparatory to a laboratory course at Sibley College, Cornell University. The first part deals with the elastic theory and the determination of the properties of materials of construction, chiefly metals, by testing. The ordinary rules connecting stress and strain are discussed, but not in general the instruments used in testing. Rather more attention is given to the behaviour of materials strained beyond the elastic limit than in treatises on applied mechanics. Some of the statements are rather too dogmatic. Is the author sure that in a tension test "the break must start at the outside and work inwards" (p. 36)? English engineers will scarcely agree with the statement that "there is not much excuse for the use of the Rankine or Ritter formulas" for columns. It will be new to them to learn that "live loads applied without shock (for example, a rolling load crossing a bridge at low speed) actually set up stresses twice as great as a dead load of the same amount." The injurious effect of a live load without shock as compared with a dead load is, not that it increases the stresses, but that it causes the "fatigue" effect. Of course, also, it produces shocks, which the author deals with separately. A live load is not a suddenly applied load. Nevertheless, this section is generally clear and useful. The discussion of the cause of fatigue failure is fuller than usual. No attempt is made to give collections of results of tests.

The second and rather larger part of the book deals with the internal structure of materials and its modification by mechanical action, heat treatment, etc. Is it true that the corrosion of iron "takes place whenever the moisture in contact with the metal becomes electrolytic either by acids or *alkalies*"? Freezing-point and equilibrium diagrams for lead-tin and iron-carbon alloys are described, and the constituents of cast-iron and steel, austenite, pearlite, ferrite, cementite, etc., are discussed very fully. So also are the variation

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